Alliance *for* Regenerative Medicine

SECTOR SNAPSHOT

DECEMBER 2024

This Year's Cell and Gene Therapy Milestones

Review of the 2024 cell and gene therapy approvals

Notable sector achievements of 2024

A look at the 2025 clinical pipeline

The Year in Review

With 2024 nearing an end, the cell and gene therapy sector has witnessed another transformative year marked by groundbreaking milestones and continued maturation. From pivotal breakthroughs to regulatory firsts, the sector is setting the stage to redefine clinical and commercial success. The Alliance for Regenerative Medicine's (ARM) final Sector Snapshot of 2024 highlights the most significant developments that have shaped the sector this year.

2024 CELL AND GENE THERAPY APPROVALS

Developer	Therapy Type (Indication)	Approved Region
Iovance Biotherapeutics	**Cell Therapy** (Metastatic Melanoma)	
Orchard Therapeutics	**Gene Therapy** (Metachromatic leukodystrophy)	
Pfizer	**Gene Therapy** (Hemophilia B)	
Adaptimmune Therapeutics	**Cell Therapy** (Advanced synovial sarcoma)	
PTC Therapeutics	**Gene Therapy** (Aromatic L-amino acid decarboxylase deficiency)	
Autolus Therapeutics	**CAR-T Cell Therapy** (B-Cell acute lymphoblastic leukemia)	
StemCyte	**Cell Therapy** (Blood and immune system disorders)	
Mesoblast	**Cell Therapy** (Steroid-refractory acute graft versus host disease)	
Humacyte	**Tissue Engineered Therapy** (Extremity Vascular Trauma)	
Vertex Pharmaceuticals and CRISPR Therapeutics	**Gene Editing Therapy** (Severe sickle cell disease and transfusion-dependent beta-thalassemia)	

Q3 2024 Sector Data

Looking to get a high-level overview of the sector before diving into this year's milestones? Last month, ARM released our latest sector data, highlighting the latest numbers for clinical trials, therapeutic developers, and investments for Q3 of this year.

➤ **You can access the full data at: www.alliancerm.org/data**

Q3 2024	North America	Asia Pacific	Europe	Total
Developers (Snapshot value)	1,262	1,036	587	2,981*
Clinical Trials (Snapshot value)	987	866	363	1,968*
Investment (Q3 2024 Total)	$1.6B	$1.1B	$0.3B	$3.0B*

GlobalData.

Totals refer to unique quantities and includes data from other regions not shown

Innovation in the Clinic

IN-VIVO'S STEADY PROGRESS

In-vivo cell and gene therapy offers new ways to treat disease and improve access for patients. This year, the sector saw several promising advances in the clinic.

Interius BioTherapeutics announced that the first patient was dosed in the first-ever in-human clinical trial of an in-vivo CAR gene therapy.

Intellia Therapeutics announced it initiated Phase 3 trials of its in-vivo CRISPR gene editing treatment to treat hereditary angioedema. It is the second-ever in-vivo CRISPR gene editing treatment to enter Phase 3.

Myeloid Therapeutics dosed its first patient in the first-ever in-vivo mRNA CAR therapy to treat advanced hepatocellular carcinoma.

Umoja Biopharma's groundbreaking gene therapy that generates CD19 CAR-T cells in situ entered clinical trials to treat r/r large B-cell lymphoma and chronic lymphocytic leukemia.

NEW GENE EDITING TECHNIQUES REACH THE CLINIC

Last year, the first-ever CRISPR/Cas9 gene editing therapy was approved for market use. Other forms of gene editing, like base editing, have been progressing in early-stage clinical trials. As these innovative techniques reach patients, newer forms of gene editing are taking shape.

Prime Editing

A high-precision tool for fixing genes that acts like a 'word processor' that can search and replace sequences within the genome.

Epigenetic Editing

A method that can potentially control gene expression like a 'series of light switches' that would fix harmful mutations without changing DNA.

2024 Milestone

PRIME Medicine moved prime editing into the clinic for the first time.

2024 Milestone

Tune Therapeutics announced the first-ever clinical trial of an epigenetic editing therapy to treat an infectious disease.

New Advances in Oncology

BREAKING THROUGH WITH SOLID TUMORS

Solid tumors have been more challenging targets for the sector than blood cancers. However, 2024 saw critical breakthroughs, with the first-ever approvals of two different adoptive cell therapies for treating solid tumors.

February 2024

Iovance Biotherapeutics received FDA approval for its tumor-infiltrating lymphocyte (TIL) therapy to treat metastatic melanoma.

August 2024

Adaptimmune Therapeutics received FDA approval for its T-cell receptor therapy to treat synovial sarcoma.

Additionally, CAR-T therapy achieved significant milestones in tackling deadly brain tumors, a challenging indication where the prognosis for patients is often incredibly bleak:

A breakthrough study conducted by Massachusetts General Cancer Center and the University of Pennsylvania and published in the New England Journal of Medicine reported that CAR-T cells engineered to target EGFRvIII mutations successfully reduced tumor size in patients while demonstrating prolonged survival benefits in early-phase studies.

A Phase 1 trial conducted by ARM member City of Hope showed promising clinical activity in its experimental CAR-T cell therapy for high-grade glioma brain tumors. This advancement underscores the potential of CAR-T therapy to transform treatment for solid tumors, combining cutting-edge engineering with clinical efficacy.

Research from a clinical trial conducted by Stanford University demonstrated that its CAR-T cells could treat brain and spinal tumors such as intrinsic pontine glioma. The therapy received fast-track designation from the FDA in October 2024.

EARLIER ACCESS TO CAR-T FOR BLOOD CANCERS

Up until this year, two CAR-T cell therapies for multiple myeloma could only be used in the US and EU as the last lines of treatment when patients exhausted all other options. In the spring, Abecma, a CAR-T therapy developed by Bristol Myers Squibb and 2seventybio, was approved as a third-line treatment in the US and EU after previously being a fifth-line treatment in both regions. Carvykti, another CAR-T developed by Legend Biotech and Janssen, was approved as a second-line treatment in the US and EU after being a fifth-line treatment in the US and a fourth-line treatment in the EU.

A CAR-T cell therapy could soon become a first-line treatment option in the fight against cancer. In October, Kite Pharma announced that its CAR-T therapy for high-risk large B-cell lymphoma received an RMAT Designation from the FDA as a first-line treatment.

Expanding Frontiers in Disease Treatment

Improving Hearing in Children

Regeneron's experimental gene therapy showed promising results for restoring hearing in children with otoferlin-related hearing loss, a genetic condition that causes deafness. In the trial, an 11-month-old had their hearing restored in 6 weeks, while a 4-year-old had their hearing restored in 24 weeks. Additionally, a clinical study sponsored by Akouos published in January 2024 showed an 11-year-old went from profound deafness to only having mild-to-moderate hearing loss.

Patients with Inherited Blindness Regain Sight

New clinical data from a trial sponsored by Editas Medicine and conducted by Mass Eye and Ear showed new potential in using CRISPR gene editing to treat individuals with inherited blindness caused by mutations in the CEP290 gene responsible for conditions like Leber congenital amaurosis (LCA1). The groundbreaking study showed that using CRISPR-Cas9 to edit the DNA of retinal cells directly inside the eye led to some vision improvement for 11 of the 14 patients in this first-of-its-kind trial. Additionally, Atsena Therapeutics and researchers at Penn Medicine announced this year that their experimental gene therapy to treat GUCY2D gene mutations that cause LCA1 was well tolerated and that some patients experienced a 10,000-fold improvement in vision.

Breakthroughs in Treating Autoimmune Diseases

While oncology continues to dominate as the primary focus for cell therapies, there is rapidly growing interest in addressing autoimmune diseases through these advanced treatments. A pivotal study published in the New England Journal of Medicine this year showed that 15 patients who received a CAR-T for their lupus nephritis did not have symptoms relapse after two years of treatment. There are dozens of clinical trials targeting autoimmune diseases such as lupus, type 1 diabetes, myasthenia gravis, and multiple sclerosis, with expectations for the scope of these therapies to expand further.

Breakthroughs Reach More Patients

COMPETING GENE THERAPY OPTIONS FOR PATIENTS

More and more patients have more than one cell and gene therapy option to treat their condition, a sign of the sector's maturation. Last year, two gene therapies were approved in the US for severe sickle cell disease, marking the first time the sector saw two gene therapies for the same indication approved in the same region. At the end of 2024, patients with hemophilia B and patients with transfusion-dependent thalassemia in the US and EU also have two options to choose from.

Competing Therapies Approved in the Same region in 2024

Disease	Company	Approval Date
Hemophilia B	CSL Behring and uniQure	2022 (US)
	Pfizer	2023 (EU), 2024 (US, EU)
Transfusion-Dependent Beta-Thalassemia	Bluebird bio	2022 (US)
	Vertex Pharmaceuticals and CRISPR Therapeutics	2024 (US)

GENE THERAPY EXPANDS GLOBALLY

CRISPR Gene Editing

2023 marked the first-ever approval of a CRISPR gene editing therapy, with approvals in the United States, the United Kingdom, and Bahrain. The momentum for this breakthrough medicine continued in 2024 with approvals in Saudi Arabia, Canada, the European Union, and Switzerland.

Brazil

In October, Brazil granted marketing authorization to PTC Therapeutics' gene therapy to treat AADC deficiency, a rare genetic disease. In the same month, GEMMA Biotherapeutics received $100 million from Fiocruz, a public health research institution within the Brazil Ministry of Health, to sponsor research on gene therapy treatments.

Turkey and Central Asia

Orchard Therapeutics announced this year that it is partnering with Er-Kim to commercialize Libmeldy, its gene therapy for metachromatic leukodystrophy, in Turkey and other Central Asian markets.

What 2025 May Have in Store

The previous milestones showed how 2024 was another incredible breakthrough year for the cell and gene therapy sector. Below is a look at what we could expect from the clinical pipeline in 2025.

2025 UNITED STATES CLINICAL PIPELINE

Therapy Name (Developer)	Therapy Type (Indication)	Regulatory Status
Tab cel *(Atara Biotherapeutics)*	**Cell Therapy** (Epstein-Barr virus-associated post-transplant lymphoproliferative disorder)	**Decision date: January 15, 2025**
NT-501 *(Neurotech Pharmaceuticals)*	**Cell Therapy** (Macular Telangie)	**Decision date: March 18, 2025**
Pz-cel *(Abeona Therapeutics)*	**Cell Therapy** (Recessive dystrophic epidermolysis bullosa)	**Decision date: April 29, 2025**
UX111 *(Ultragenyx)*	**Gene Therapy** (Mucopolysaccharidosis Type IIIA (MPS IIIA))	**FDA Biologics Application License submitted**
PRGN-2012 *(Precigen)*	**Gene Therapy** (Recurrent respiratory papillomatosis)	
Deramiocel *(Capricor Therapeutics)*	**Cell Therapy** (Duchenne muscular dystrophy cardiomyopathy)	
RPL102 *(Rocket Pharmaceuticals)*	**Gene Therapy** (Fanconi anemia)	**FDA Biologics License Application submission possible in 2025**
RGX-121 *(REGENXBIO)*	**Gene Therapy** (Hunter syndrome)	
Isaralgagene civaparvovec *(Sangamo Therapeutics)*	**Gene Therapy** (Fabry disease)	
MCO-010 *(Nanoscope Therapeutics)*	**Gene Therapy** (Retinitis pigmentosa)	
Kresladi *(Rocket Pharmaceuticals)*	**Gene Therapy** (Severe leukocyte adhesion deficiency type 1)	
Rilparencel *(Prokidney)*	**Cell Therapy** (Kidney disease)	
rexlemestrocel-L *(Mesoblast)*	**Cell Therapy** (End-stage ischemic heart failure)	
DTX401 *(Ultragenyx)*	**Gene Therapy** (Glycogen story disease type 1a)	
Anito-cel *(Arcellx)*	**CAR-T** (Multiple myeloma)	
AMT-130 *(uniQure)*	**Gene Therapy** (Huntington's disease)	

2025 EUROPEAN UNION CLINICAL PIPELINE

Therapy Name (Developer)	Therapy Type (Indication)	Regulatory Status
Vyjuvek *(Krystal Biotech)*	**Gene Therapy** (Dystrophic epidermolysis bullosa)	**EMA Marketing Authorization Application submission accepted (EMA CHMP opinion pending)**
RPL102 *(Rocket Pharmaceuticals)*	**Gene Therapy** (Fanconi anemia)	
Obe-cel *(Autolus Therapeutics)*	**CAR-T** (B-cell acute lymphoblastic leukemia)	
UM171 *(ExCellThera)*	**Cell Therapy** (Hematological malignancies in patients who lack a readily available suitable donor)	
Elevidys *(Sarepta Therapeutics and Roche)*	**Gene Therapy** (Duchenne muscular dystrophy)	**EMA Marketing Authorization Application submitted**
Lifileucel *(Iovance Biotherapeutics)*	**Cell Therapy** (Metastatic melanoma)	
OCU400 *(Ocugen)*	**Gene Therapy** (Retinitis pigmentosa)	**EMA Marketing Authorization Application submission possible in 2025**
Ixo-vec *(Adverum)*	**Gene Therapy** (Wet AMD)	

Stay Connected

Cell and Gene State of the Industry Briefing
San Francisco, CA

January 13, 2025
alliancerm.org/events

Cell and Gene Meeting on the Med
Rome, Italy

April 15-17, 2025
meetingonthemed.com

Cell and Gene Meeting on the Mesa
Phoenix, AZ

October 6-8, 2025
meetingonthemesa.com

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